

Hydrologic Model Manager

Short Name	BLTM
Long Name	Branched Lagrangian Transport model
Description	
Model Type	The BLTM is a general-purpose transport model for unsteady flow in a system of one-dimensional channels. It routes any number of constituents. Reaction kinetics all are contained in a single subroutine which can be easily modified to fit a particular application. The model comes with three reaction kinetics subroutines, a simple first order decay of each constituent, a temperature model, and the reaction kinetics found in the EPA QUAL2E water quality model.
Model Objectives	To route chemically interacting dissolved constituents through a series of inter connected one-dimensional channels.
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Model Structure	The BLTM routes any number of interacting dissolved constituents through a system of bi-directional, one-dimensional open channels. Flow hydraulics must be supplied externally, normally by a flow model such as the DAFLOW model. The convective-diffusion equation is solved using a Lagrangian reference frame that minimizes numerical dispersion. It can, therefore, be used to route sharp concentration gradients such as occur in an estuary.
Interception	
Groundwater	
Snowmelt	
Precipitation	
Evapo-transpiration	
Infiltration	
Model Paramters	The only model parameters are the dispersion coefficient and coefficients which define the chemical inter-actions. Each constituent is assumed have one zero order reaction and to react with itself and each other routed constituent as a first order reaction with an equilibrium concentration at which the reaction ceases. This allows the user to define $N + 2N^2$ reaction coefficients, where N is the number of constituents being routed, to define the interactions. Any coefficient can be a function of external variables such as solar radiation, internal variables such as depth or velocity, or the concentration of any routed constituent such as temperature of dissolved oxygen concentration.
Spatial Scale	The model has been used to route constituents in rivers of all sizes, as well as flume flows.
Temporal Scale	Typically the models is operated with a 1-hour time step, but the time step depends entirely on the scale of the system. Generally it is operated using a daily time step when simulating transport in the Mississippi River and with a very short time step when routing the dye concentration just downstream of an

	instantaneous dye dump into a small stream.
Input Requirements	Input data includes the flow hydraulics including the discharge, flow area, top width, and tributary inflow at each node for each time step. This information is typically supplied to a file by a flow model such as DAFLOW, BRANCH, or FEQ. In addition a time series of the concentrations of each routed constituent is needed for each inflow point and a time series of any external meteorological or other information that may be needed to compute the reaction coefficients. The dispersion coefficient is needed for each subreach of the model and all reaction coefficients must be defined.
Computer Requirements	The BLTM model operates under DOS on any 286, or better, machine. Depending on the application, only 640K of memory and 1.5mb of disk space are required.
Model Output	The BLTM model produces concentration output at user specified locations and time intervals. In addition it supplies the parcel number as well as its volume, the time it entered the branch and a tabulation of the concentration when it entered the branch and the changes that have occurred as a result of dispersion, tributary inflow, and each chemical reaction.
Parameter Estimatr Model Calibrtn	Calibration generally begins with assuring that the flow velocity provided by the transport model is representative of the actual velocity in the river. When using the DAFLOW model to supply the hydraulics, the water velocity can be adjusted independently of the hydraulic calibration. Once the timing is correct the dispersion coefficient is calibrated and finally the reaction rate coefficients are adjusted such that the computed and observed time series of concentrations agree.
Model Testing Verification	The model has been tested against theoretical solutions and numerous sets of field data.
Model Sensitivity	Model sensitivity depends strongly on the constituent being routed. When routing a nearly conservative substance, such as dye, timing (transport velocity) is usually the most important variable followed by the dispersion coefficient. When the constituents are strongly interactive, the reaction coefficients are generally the most significant variables.
Model Reliability	Model stability and repeatability are excellent.
Model Application	<p>The following are references to reports for projects that have used the BLTM model.</p> <p>Bulak, James S., Hurley, Noel M. Jr., and Crane, John S. Production, Mortality, and Transport of Striped Bass Eggs in Congaree and Wateree Rivers, South Carolina, American Fisheries Society Symposium 14, 1993, page 29-37.</p> <p>Conrads, Paul A., 1998, Simulation of temperature, nutrients, biochemical oxygen demand, and dissolved oxygen in the Ashley River near Charleston, South Carolina: U.S. Geological Survey Water Resources Investigations Report 98-4150, Columbia, South Carolina, 56 pages.</p> <p>Conrads, P.A. and P.A. Smith, 1996, Simulation of Water Level, Streamflow, and Mass Transport for the Cooper and Wando Rivers near Charleston, South Carolina, 1992-95: U.S. Geological Survey Water Resources Investigations Report 96-4237, Columbia, South Carolina, 51 pages.</p> <p>Conrads, P.A. and P.A. Smith, 1997, Simulation of temperature, Nutrients, Biochemical Oxygen Demand, and Dissolved Oxygen in the Cooper and Wando Rivers near Charleston, South Carolina, 1992-95: U.S. Geological Survey Water Resources Investigations Report 97-4151, Columbia, South Carolina, 58 pages.</p> <p>Drewes, P.A. and P.A. Conrads, 1995, Assimilative Capacity of the Waccamaw River and the Atlantic Intracoastal Waterway near Myrtle Beach, South Carolina, 1989-1992: U.S. Geological Survey Water Resources Investigations Report 95-4111, Columbia, South Carolina, 58 pages.</p> <p>Hurley, N.M. Jr. 1991, Transport Simulation of Striped Bass Eggs in the Congaree, Wateree, and Santee Rivers: South Carolina: U.S. Geological Survey Water-Resources Investigations, Report 91-4088, Columbia, South Carolina.</p> <p>California Water Resources Control Board, 1994, Methodology for flow and salinity estimates in the Sacramento-San Joaquin Delta and Suisun Marsh:</p>

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Documentation

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Other Comments

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Developer

Technical Contact

Contact Organization